



US008281483B2

(12) **United States Patent**
Hofmann et al.

(10) **Patent No.:** **US 8,281,483 B2**
(45) **Date of Patent:** **Oct. 9, 2012**

(54) **FIXTURE FOR ALIGNING AN ELECTRONIC COMPONENT**

(75) Inventors: **Thomas Hofmann**, Stephanskirchen (DE); **Johann Poetzinger**, Fischbachau (DE); **Necati Efe Varol**, Rosenheim (DE)

(73) Assignee: **Multitest Elektronische Systeme GmbH**, Rosenheim (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **12/858,394**

(22) Filed: **Aug. 17, 2010**

(65) **Prior Publication Data**

US 2011/0042264 A1 Feb. 24, 2011

Related U.S. Application Data

(60) Provisional application No. 61/234,729, filed on Aug. 18, 2009.

(51) **Int. Cl.**
B23P 19/00 (2006.01)

(52) **U.S. Cl.** **29/739; 29/740; 29/759; 29/832**

(58) **Field of Classification Search** **29/739, 29/740, 827, 830, 842, 759, 832**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,427,249 A 1/1984 Bright et al.
4,782,589 A * 11/1988 Dennis 29/827
5,176,255 A * 1/1993 Seidler 206/724
5,215,472 A 6/1993 DelPrete et al.
5,307,929 A * 5/1994 Seidler 257/676

5,333,375 A * 8/1994 Dennis et al. 29/827
5,596,229 A 1/1997 Simon
5,872,458 A 2/1999 Boardman et al.
5,878,485 A * 3/1999 Wood et al. 29/825
6,268,740 B1 7/2001 Iida
7,129,726 B2 10/2006 Tashiro et al.
7,156,680 B2 1/2007 Saito
7,410,363 B1 8/2008 Gattuso et al.
2003/0017629 A1 1/2003 Tsui et al.
2006/0154386 A1 7/2006 Cheng et al.

(Continued)

FOREIGN PATENT DOCUMENTS

JP 07-106799 4/1995

(Continued)

OTHER PUBLICATIONS

Anonymous: "Airjaw centering device," Research Disclosure, Mason Publications, vol. 324, No. 49, Apr. 1, 1991 (1 page).

(Continued)

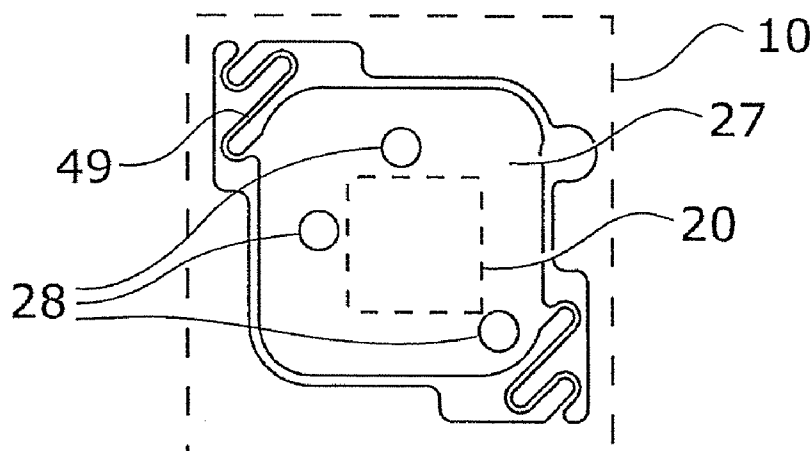
Primary Examiner — Carl Arbes

(74) *Attorney, Agent, or Firm* — Christie, Parker & Hale, LLP

(57) **ABSTRACT**

An align fixture for aligning an electronic component having a receptacle adapted to receive the electronic component, the receptacle having a first abutting section and a second abutting section, the align fixture further having an elastic unit, one of the first abutting section and the second abutting section is flexibly mounted via the elastic unit, and the other one of the first abutting section and the second abutting section is fixedly mounted; the first abutting section and the second abutting section each form a stiff member and are adapted to engage the electronic component, the elastic unit is adapted to exert two force components on one of the first abutting section and the second abutting section, the force components being angled relatively to one another.

15 Claims, 9 Drawing Sheets



U.S. PATENT DOCUMENTS

2006/0220667 A1 10/2006 Tashiro et al.
2007/0285106 A1 12/2007 Henry et al.

FOREIGN PATENT DOCUMENTS

JP 10-284878 10/1998
JP 2000-49210 2/2000
JP 2006-284384 10/2006
WO WO 2009/100910 A1 8/2009

OTHER PUBLICATIONS

EPO Search Report for EP 10171333.7 dated Jul. 6, 2011 (3 pages).
English Translation of Japanese Office action dated Mar. 26, 2012 for
Japanese Patent Application No. 2010-181844, date of mailing Apr.
3, 2012, 6 pages.
KIPO Notification of Ex Officio Provisional Refusal dated Oct. 28,
2011, for Korean Application No. 10-2010-0080027, 5 pages.

* cited by examiner

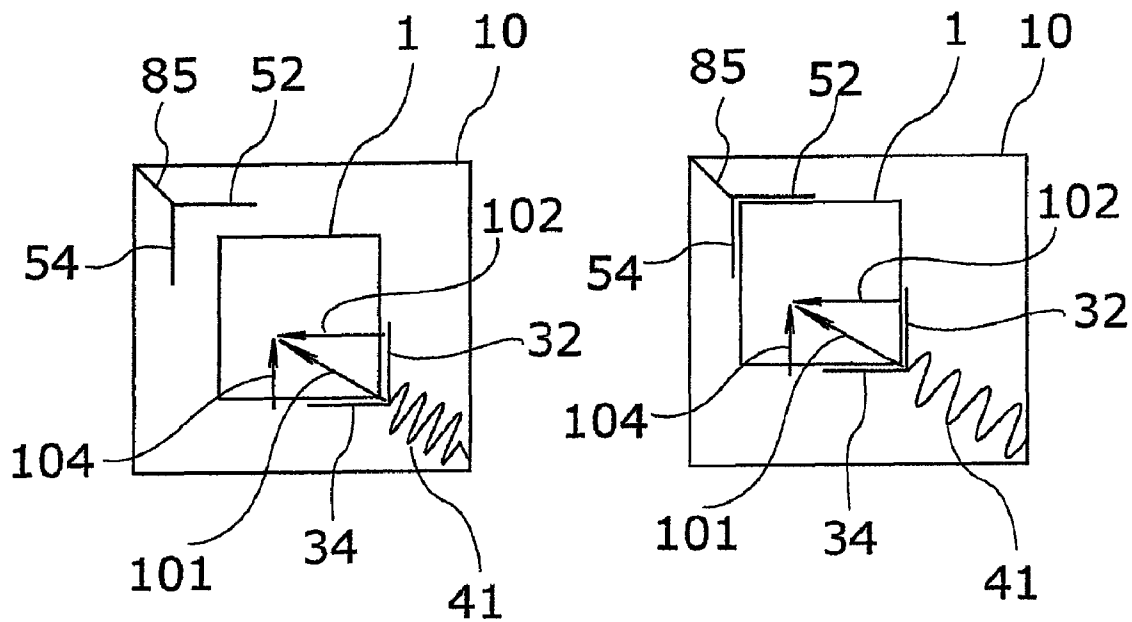


Fig. 1

Fig. 2

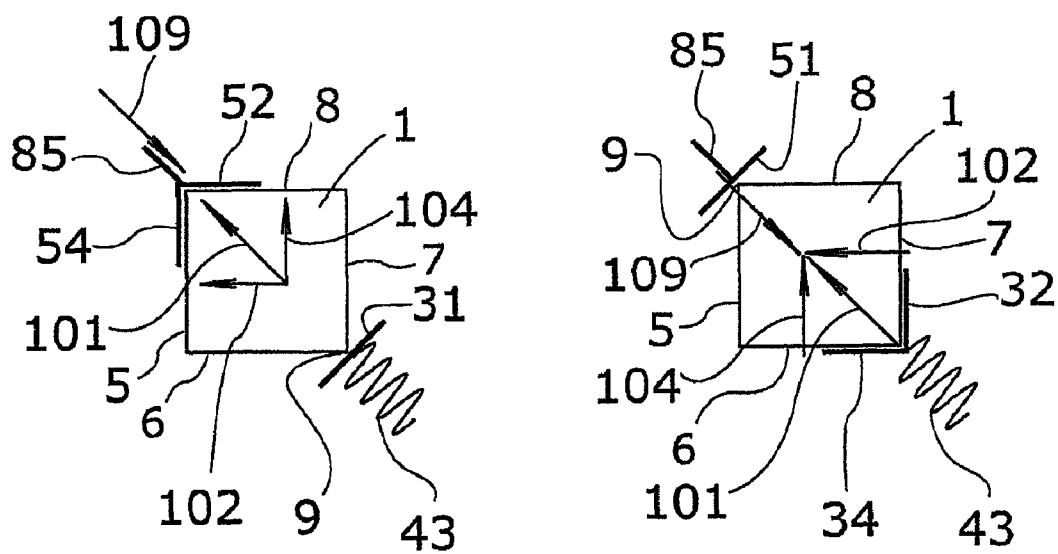
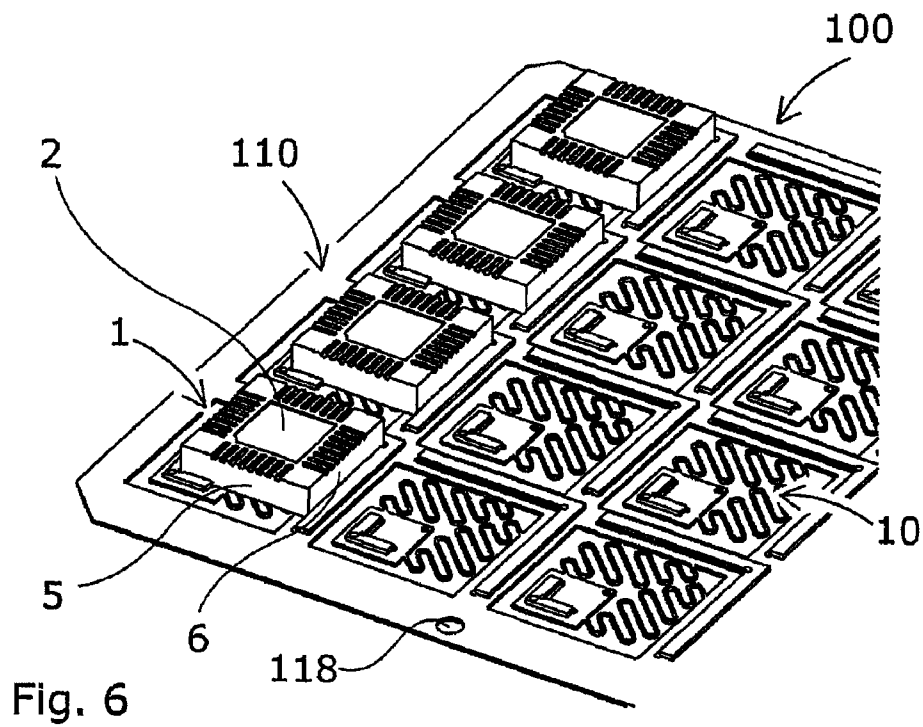
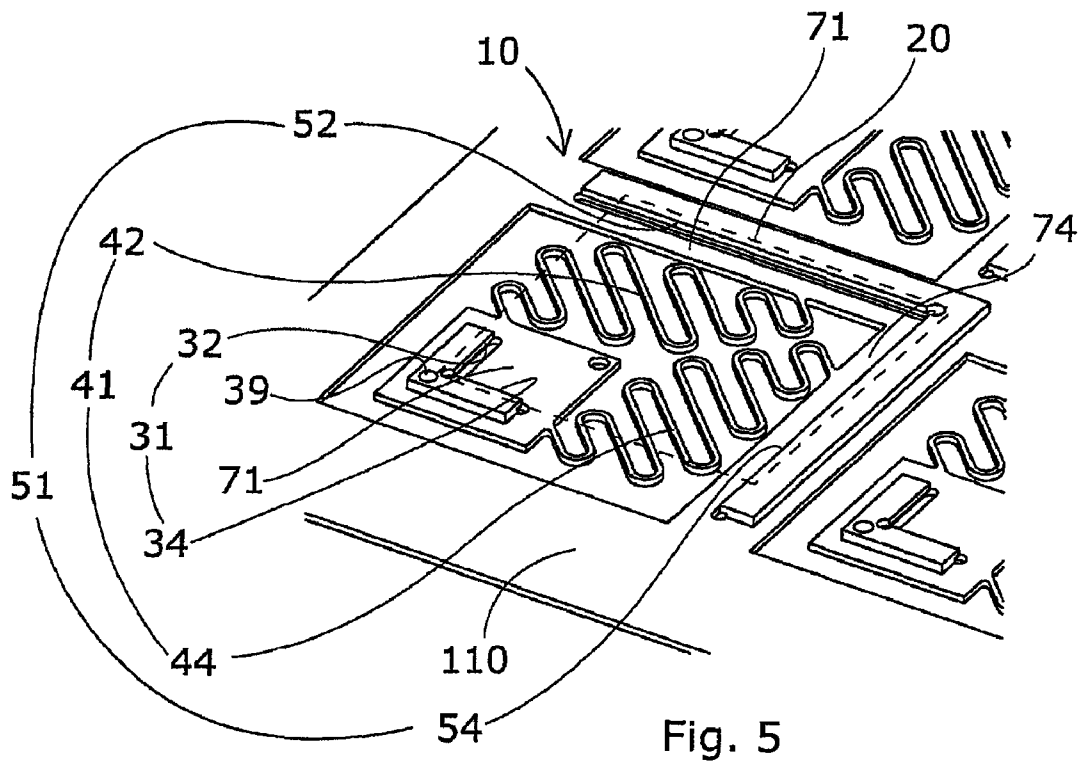


Fig. 3

Fig. 4



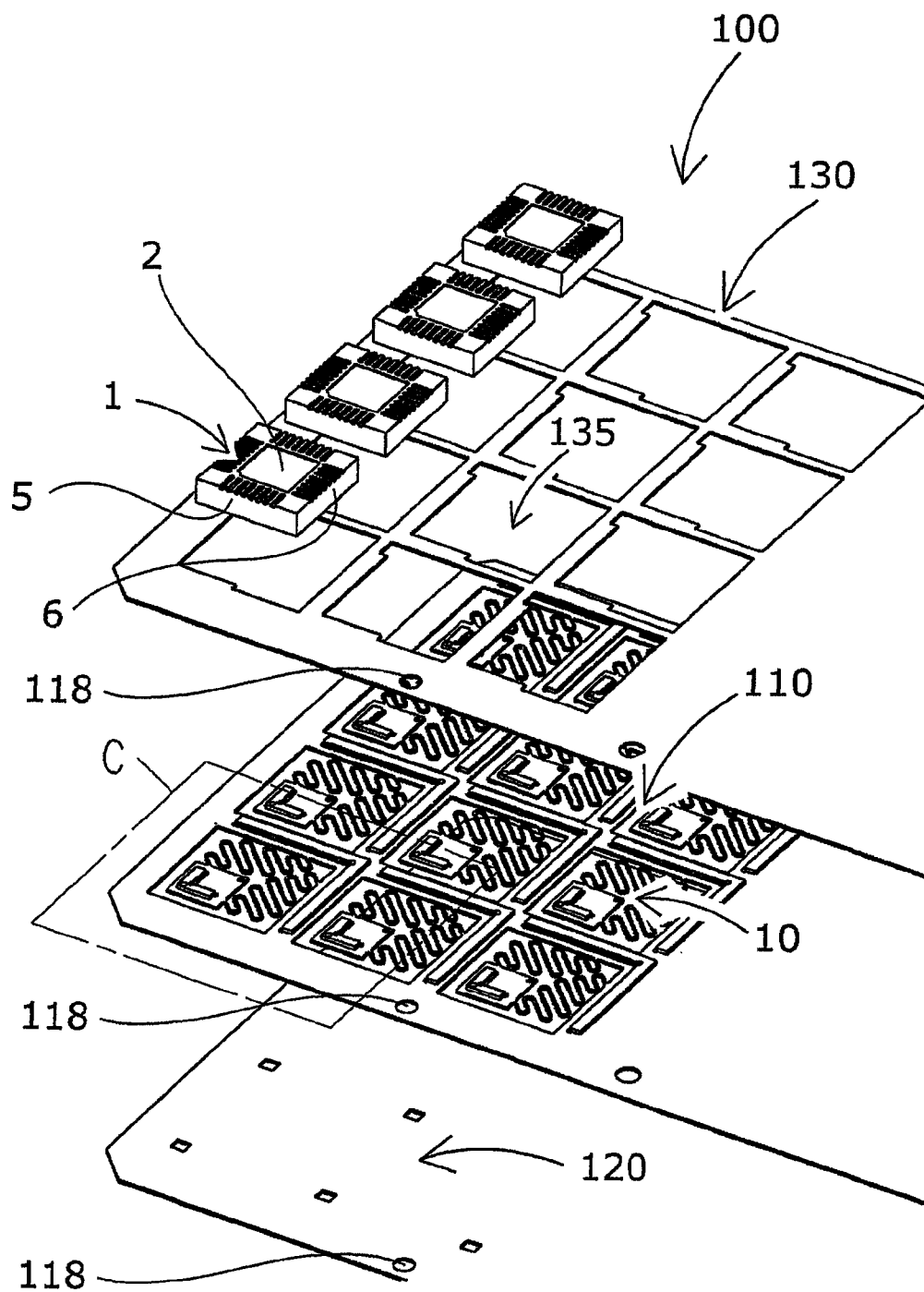


Fig. 7

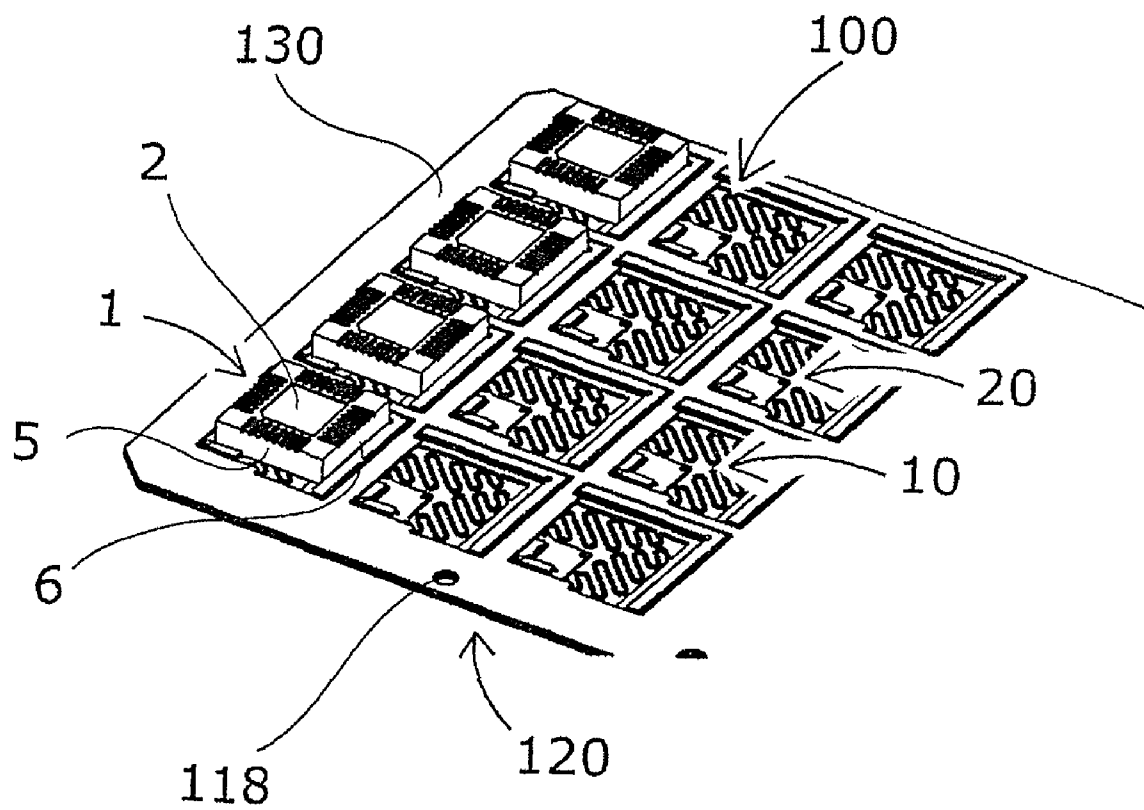
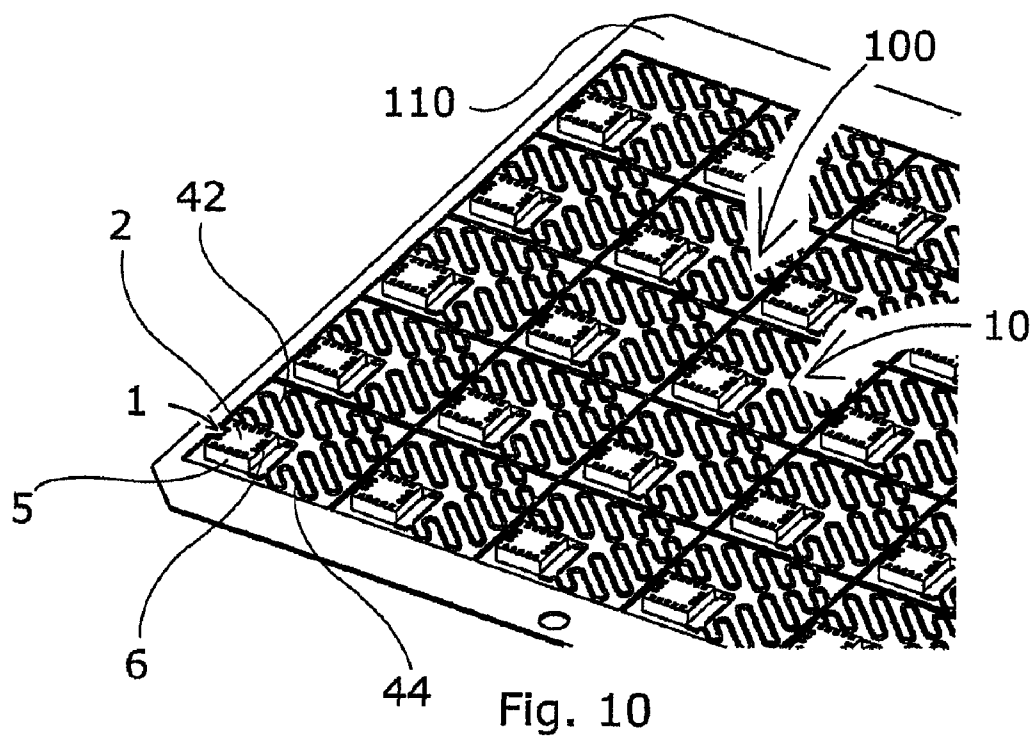
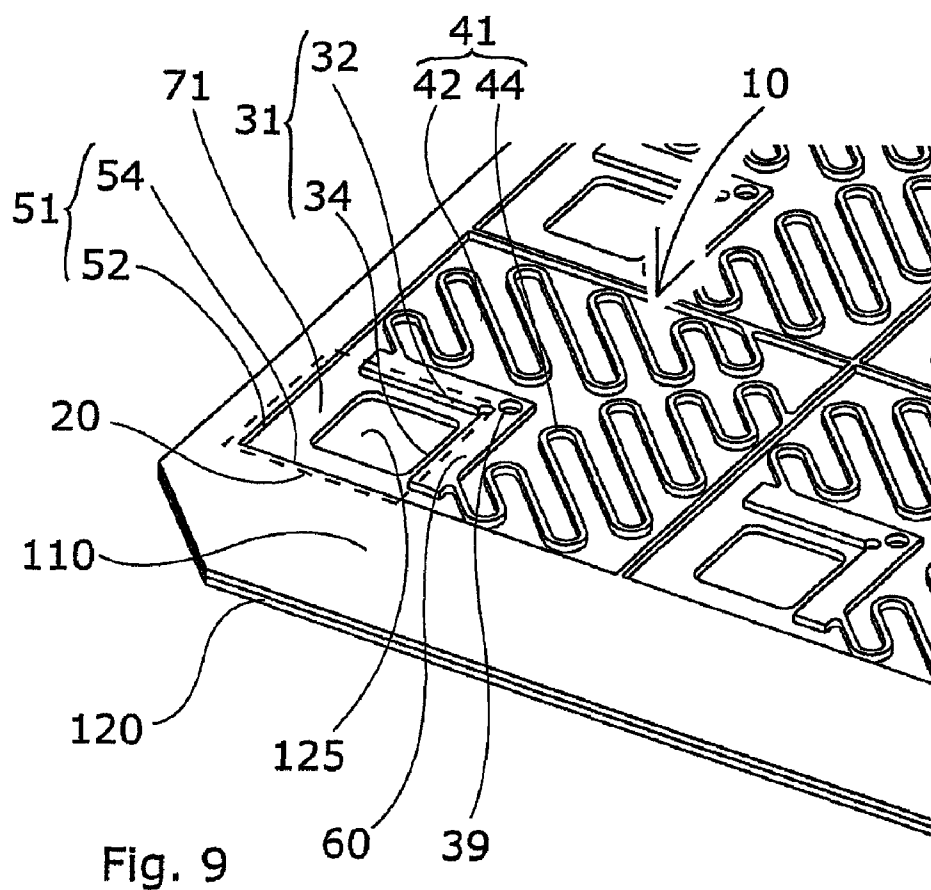


Fig. 8



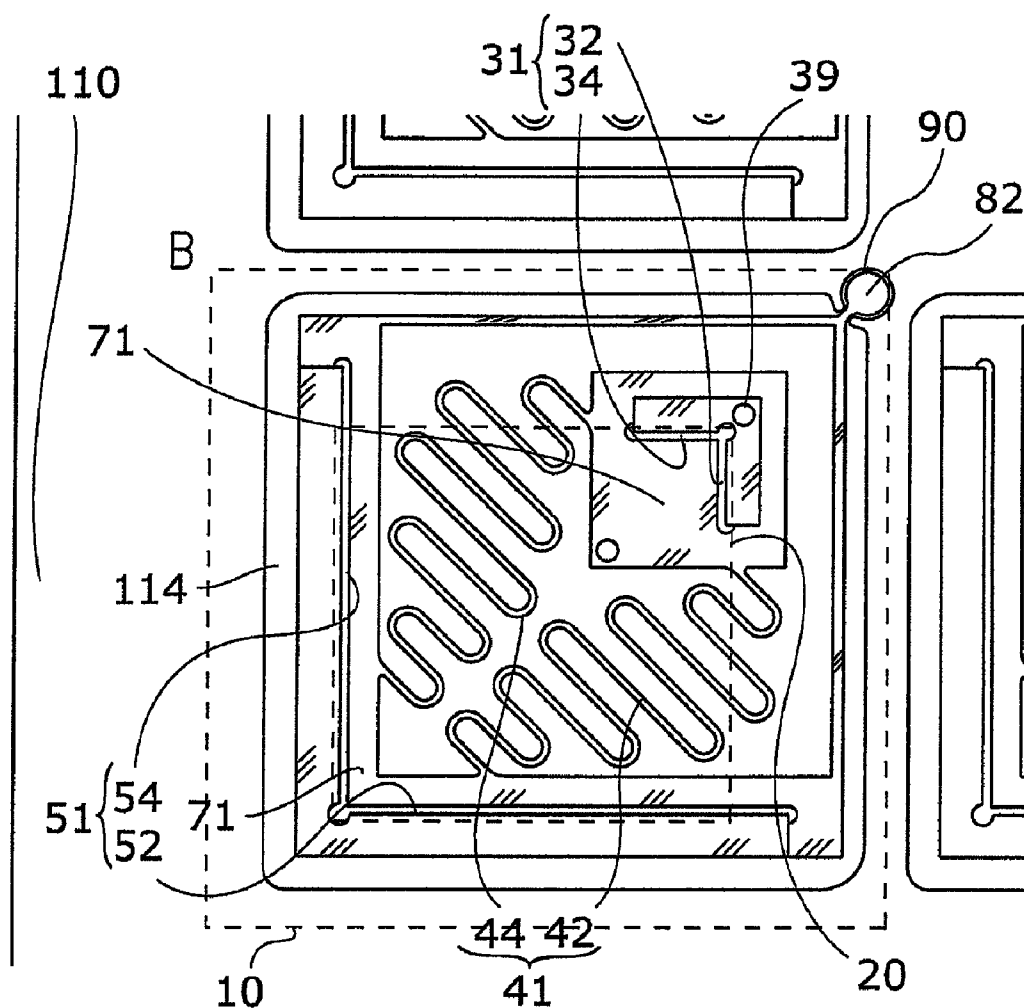


Fig. 11

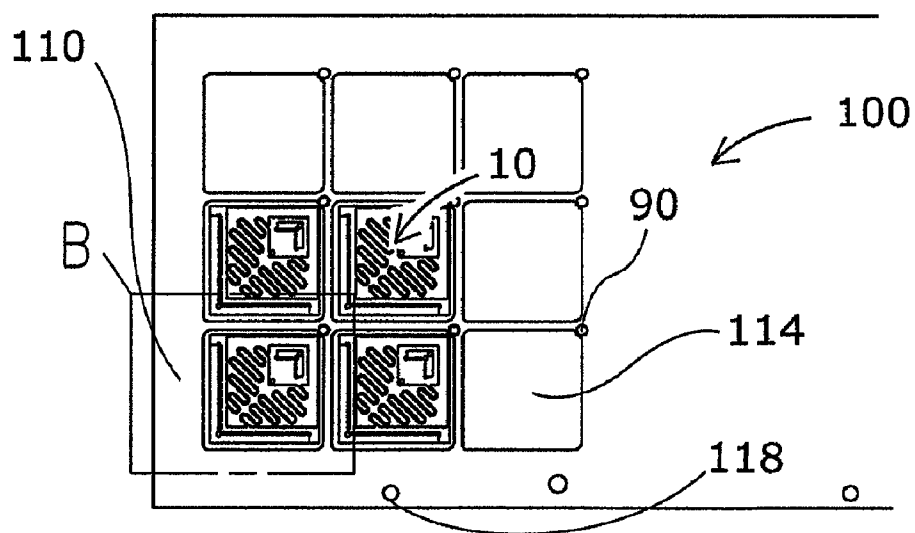


Fig. 12

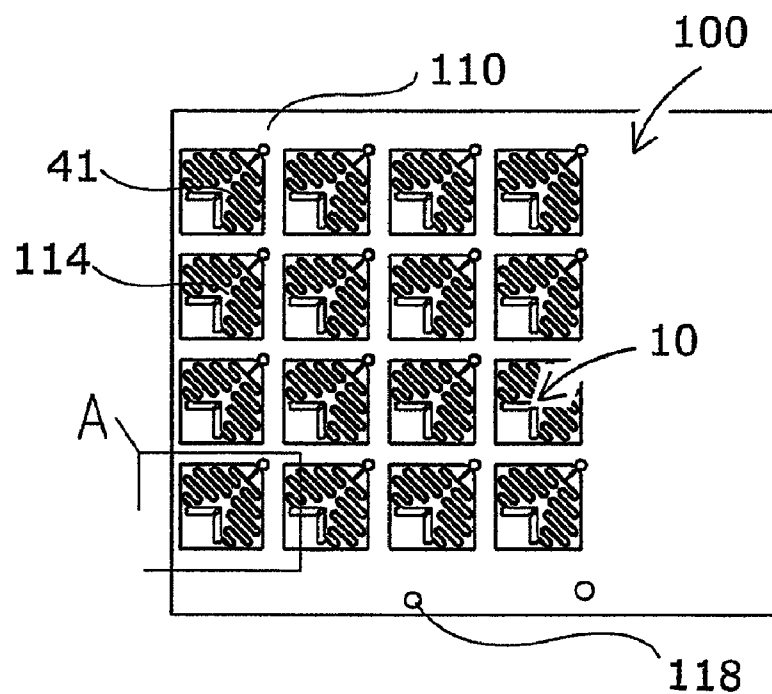
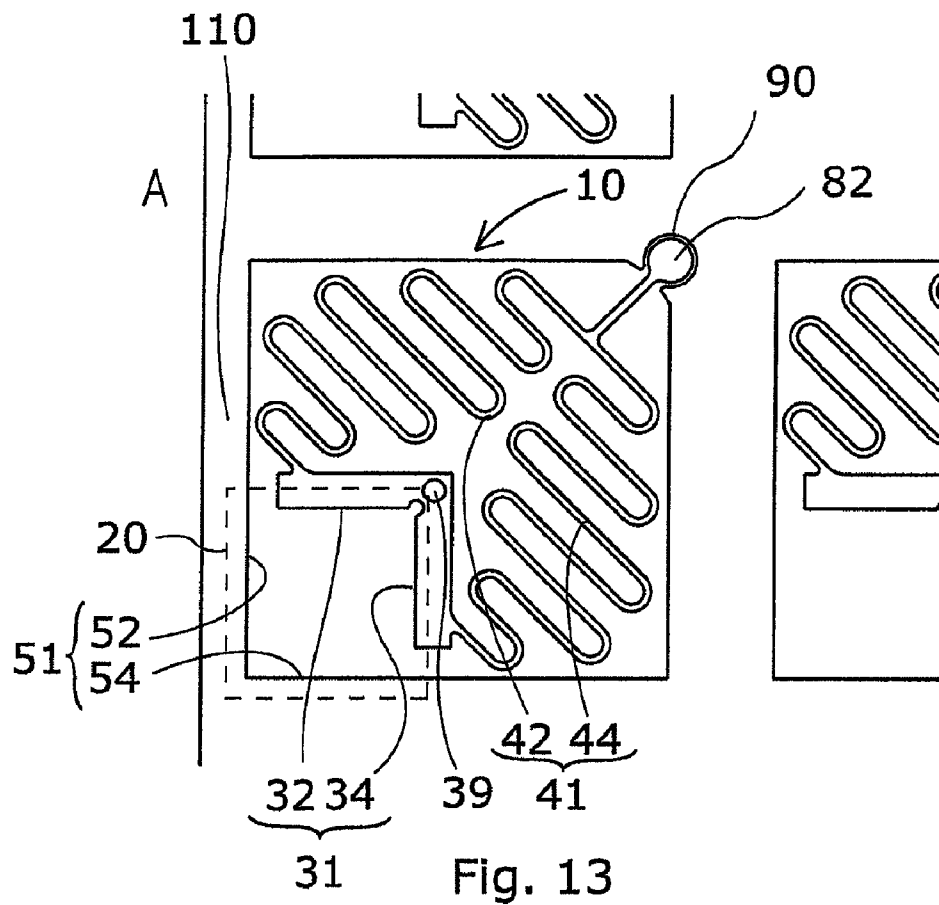


Fig. 14

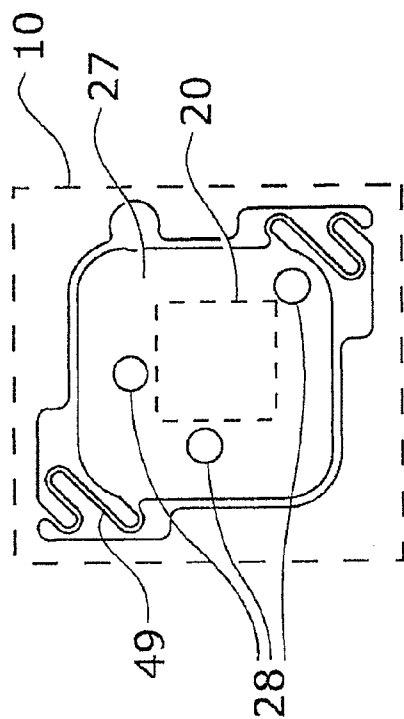


Fig. 15

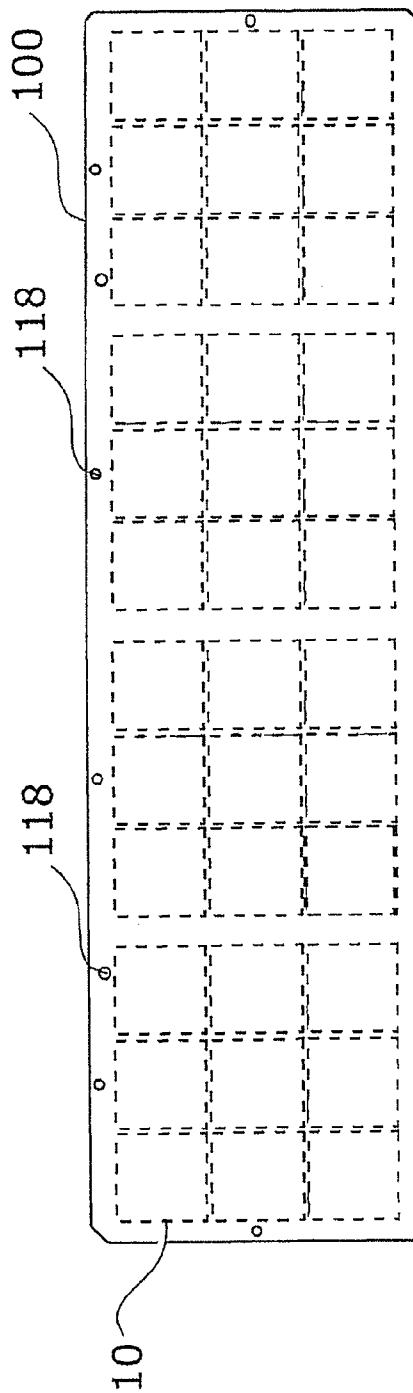


Fig. 16

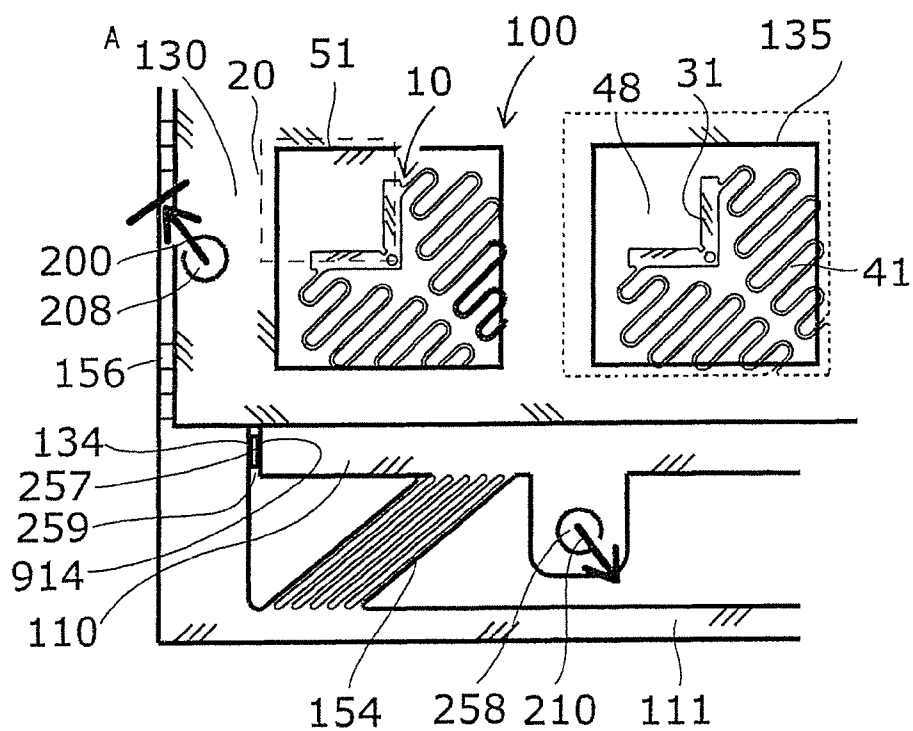


Fig. 17

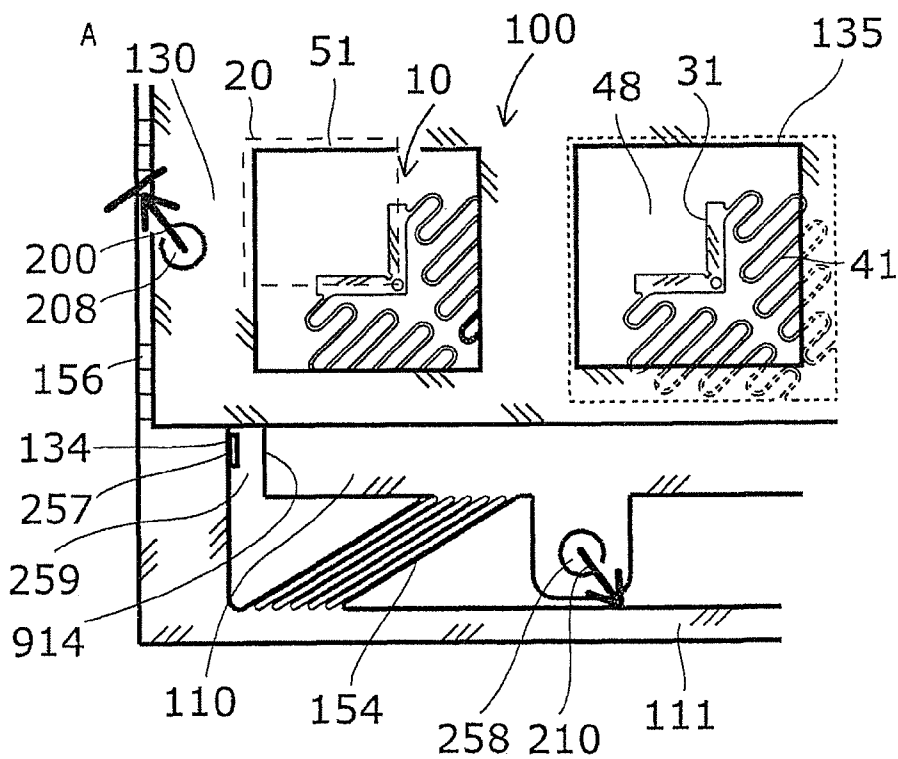


Fig. 18

1

FIXTURE FOR ALIGNING AN ELECTRONIC COMPONENT

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Patent Application No. 61/234,729, filed on Aug. 18, 2009 in the United States Patent and Trademark Office, the entire content of which is incorporated herein by reference.

FIELD OF THE INVENTION

The invention relates to an align fixture for aligning an electronic component. Moreover, the invention relates to a carrier.

Beyond this, the invention relates to a method of using the carrier.

BACKGROUND OF THE INVENTION

Integrated circuits are usually fabricated on semiconductor wafers. The integrated circuits have a variety of uses and can be found in versatile electric devices. Depending on the purposes they are made for the integrated circuits and other electronic components such as resistors, capacitances and inductances are packaged, marked and tested before being assembled. For example, MEMS (micro electro mechanical system) components are tested under given temperatures, pressure, angles of inclination and different types of accelerations. Hence, the complete manufacturing of electronic components can be divided into processes of pure fabrication and a process after finishing the contact patterns of the electronic components. There are three types of machine which handle electronic components the so called "Gravity handler" and "Pick & Place handler" handling singulated electronic components and the "Strip handler" which handle so called strips.

US 2003/0017629 A1 discloses an apparatus for supporting singulated electronic devices during a testing operation, comprising: a main body and a support member, wherein said support member is made of non-conducting high-resistivity material and comprises a plurality of recesses, each said recess being adapted to receive an individual singulated device. There is also disclosed a method for testing such devices in which the devices are carried on support members through a testing process including one or more environmental control chambers.

US 2006/0154386 A1 discloses an apparatus and method are provided for aligning a plurality of semiconductor devices placed on a carrier. Alignment guides are located adjacent to each device in use, and arranged such that they correspond to a desired alignment of each semiconductor device. For alignment, the semiconductor devices are held by a positioning device comprising a plurality of holders, each holder being configured to generate a force to hold a semiconductor device. Actuators are also provided that are operative to move the positioning device and holders to bias the semiconductor devices against the alignment guides to orientate the semiconductor devices until they are aligned with said alignment guides.

U.S. Pat. No. 7,156,680 B2 discloses an insert and electronic component handling apparatus provided with the same. To provide a guide core capable of being detachably attached to an insert body and an insert body to which the guide core can be detachably attached, U.S. Pat. No. 7,156,680 B2 provides a guide core able to be attached in a detachable way to

2

an insert body, comprising a supporting portion capable of supporting an external terminal face of an area array type electronic component so that external terminals of the area array type electronic component are exposed to the direction of connection terminals of a socket, and a hook receiver able to be engaged in a releasable way with a hook portion provided to the insert body, and an insert body able to be attached in a detachable way with the guide core, comprising an electronic component guide portion comprising a guide core attachment socket to which the guide core is attached, and an electronic component inlet connected with the guide core attachment socket so that an electronic component can be guided to the guide core attached to the guide core attachment socket, and a hook portion able to be engaged in a releasable way with a hook receiver provided to the guide core.

U.S. Pat. No. 5,596,229 A discloses a chip carrier structure for containing a chip carrier having electrical contact pads having a positioning structure for the chip carrier and a slotted structure mated to form a mated structure containing said chip carrier, the slots of the slotted structure being in alignment with the pads of the chip carrier to provide electrical and mechanical access to the pads from the exterior to the interior of the mated positioning and slotted structures.

OBJECT AND SUMMARY OF THE INVENTION

There may be a need for a system capable of aligning an electronic component in an efficient way.

In order to achieve the object defined above, an align fixture for aligning an electronic component, a carrier comprising multiple align fixtures, and a method of using a carrier are provided.

According to an exemplary embodiment of the invention, an align fixture for aligning an electronic component is provided, wherein the align fixture comprises a receptacle (which may be denoted as a device to receive and contain something) adapted (particularly intended) to receive the electronic component, the receptacle having a first abutting (particularly touching) section (particularly segment) and a second abutting (particularly touching) section (particularly segment); an elastic (particularly flexible, resilient or springy) unit (particularly a piece or complex of apparatus serving to perform one particular function). One of the first abutting section and the second abutting section is flexibly mounted via the elastic unit, and the other one of the first abutting section and the second abutting section is fixedly (particularly firmly or solidly) mounted. The first abutting section and the second abutting section each form a stiff (particularly inelastic, inflexible, rigid, unbending or unflexible) member (particularly part) and are adapted to engage (particularly come into contact with) the electronic component. The elastic unit is adapted to exert (particularly apply) two force components on one of the first abutting section and the second abutting section, the force components being angled relatively to one another (particularly enclosing an angle which is, beyond tolerances, different from zero).

According to another exemplary embodiment of the invention, a carrier for aligning multiple electronic components is provided, wherein the carrier comprises multiple align fixtures having the above mentioned features.

According to still another exemplary embodiment of the invention, a method of using a carrier having the above mentioned features is provided, wherein the method comprises:

actuating a clamping mechanism to expose openings in the receptacles being larger than the electronic components (particularly moulded parts) to be received;

positioning (particularly placing) the electronic components in the openings in the receptacles (particularly after exposing the openings);

actuating the clamping mechanism to reduce a size of the opening so that the electronic components are aligned within the receptacles of the carrier (particularly after positioning).

The term "align fixture" may particularly denote a device for supporting a physical structure during machining or handling. A "physical structure" may in this context particularly denote the material, piece of material or electronic component that is operated upon at any stage in the process of manufacture or handling.

The term "align" may particularly denote that something is ranged or lined up. E.g. an electronic component may be aligned with a fixed abutting section.

The term "electronic component" may particularly denote any component adapted for being mounted on an electronic support substrate such as a printed circuit board. Such electronic components may also be handled by a handling machine, the so called "handler". Examples for electronic components are electronic chips, i.e. packaged dies or naked unpackaged dies.

The term "receptacle" may particularly denote a device to receive and contain something or may more particularly denote a container for an electronic component.

The term "abutting section" may particularly denote a touching segment, i.e. a portion of a receptacle which directly abuts to an electronic component.

The term "the elastic unit is adapted to exert two angled force components" may particularly denote that a force may be split into two rectangular force components acting on a surface. A skew force exerted by the elastic unit may act on at least one of the first and second abutting sections to apply on the at least one of the abutting sections two force components which are angled to each other. Two angled force components may be caused by a skew force exerted by the elastic unit. "Skew" force in this context may denote that a force is not parallel to a surface, i.e. the first and second abutting sections, but includes an angle to the surface which angle deviates from being parallel at least in an angle of 0.5°, 1°, 2°, 4°, 8° or 16°. The angle may be larger than 10°, particularly larger than 30°, more particularly larger than 45°. The skew force may be denoted as being angular. In one embodiment the force may be directed on at least one rectangular abutting section in an angle of 45° relative to an internal angle of a rectangular abutting section. The skew force may be expressed by a force being exerted diagonally.

The term "carrier" may particularly denote a container for carrying or a device that carries. A carrier may be a strip-like member adapted for carrying multiple electronic components in receptacles of the carrier. Such a carrier may be used in conjunction with a handler allowing to handle the electronic devices using the carrier for subsequently carrying out a test (such as a function test) of the electronic components.

The term "clamp" may particularly denote that the carrier is designed to have parts brought together for holding or compressing the electronic components. The parts which may be brought together may be the first abutting sections and the second abutting sections. The clamping may be elastically. The term "elastic" may particularly denote that a force may be exerted which is particularly flexible, resilient or springy such as a Hook force.

According to an exemplary embodiment of the invention, an align fixture may be provided which aligns an electronic component in a self-acting manner in a receptacle. A skew force, e.g. a diagonally acting force (which respect to a for instance rectangular electronic device), may exert two angled

force components on at least one of the first abutting section and the second abutting section. The force which may be skew or angular may be transmitted from the abutting section (being flexibly mounted on the elastic unit) via the electronic component to the abutting section being fixedly mounted. In an embodiment, the skew force may act in a non-parallel direction to each of the side sections of the electronic component. By providing two angled force components exerted by an elastic unit the electronic component may be fully aligned by the first abutting section and the second abutting section without the need of further lateral abutment of the electronic component within the receptacle. This may be advantageous because only one elastic unit and two abutting portions may be sufficient for aligning the electronic component. The process of designing and manufacturing of the align fixture may be cost effective. When the electronic component being engaged by two angled side sections of one of the abutting sections the alignment of the electronic component may be reliable due to the fact that only one elastic unit is used. An orientation of one elastic unit may define the direction of the skew force and the direction and value of the two angled force components. The skew force may be skew or angular relative to the side sections of the electronic component. The directions of the first abutting section and the second abutting sections may be defined to be parallel to the orientation of the side sections of the electronic component, respectively.

In an embodiment, a carrier may be provided for aligning multiple components, wherein the carrier comprises multiple align fixtures. The multiple align fixtures may be arranged in a matrix form (i.e. in rows and columns) and may be fixedly mounted together to form the carrier. The carrier may have similar properties like the single align fixture but may be applicable on multiple electronic components, i.e. may carry multiple electronic components at the same time. The electronic components may be aligned in defined manner in the receptacles by the align fixtures of the carrier. Thus, the carrier is adapted to allow for aligning multiple electronic components.

According to an exemplary embodiment of the invention, a method of using the carrier may be provided, wherein the electronic components may be placed in temporarily enlarged receptacles of the carrier and thereupon may be elastically clamped and aligned by a clamping mechanism in a reduced size of the receptacles. The transition of the enlarged size of the receptacles to a clamping size of the receptacles may take place in a self-acting manner.

In the following, further exemplary embodiments of the align fixture will be described. However, these embodiments also apply to the carrier and to the method.

The align fixture may comprise an actuatable structure formed at the first abutting section, wherein the actuatable structure may be actuatable by a corresponding actuation structure (of a handler device or the like) for manipulating the receptacle. The actuatable structure may be for instance a recess, a protrusion, etc. which can be actuated by any appropriate force application mechanism (for instance applying a mechanical force, an electric force, a magnetic force, etc.) controlled by the actuation structure. The actuation structure may be configured (for instance shaped and/or dimensioned) correspondingly to the actuatable structure and may be for instance a protrusion or any other force application element which can actuate the actuatable structure using any appropriate force application mechanism (for instance applying a mechanical force, an electric force, a magnetic force, etc.) for controlling the receptacle in a desired way (for instance for temporarily enlarging or reducing an opening thereof).

5

An actuable structure (particularly an actuable hole, an actuable pin or an actuable arm) may be adapted to be actuated to, in turn, actuate the elastic unit. The actuable structure may be located besides the receptacle (particularly beside a boundary area of the receptacle). The actuable structure and the first abutting section may form a stiff member. The actuable structure may be accessible (by an actuation element controlled by a controller of a handler) from a side from which the electronic component is to be received.

At least one of the first abutting section and the second abutting section may be adapted to engage two angled side sections of the electronic component in a form locking (particularly fastening) manner. The electronic component may be a semiconductor component and may have a basically cuboid shape with six different surfaces. The two opposing main surfaces, the so called symbol side and the parallel contact side, may denote a main plane of the semiconductor component since it is usually the symbol side and the contact side having a greater area than the remaining four side sections of the semiconductor component. Thus, the height of the electronic component defined by the height of the side sections of the electronic component may be smaller than a length of the both sides of the main surfaces.

Three arrangements may be applied: First, the electronic component may abut with one part of one first of its side sections and may abut with one further part of a second of its side section on the abutting section being mounted via the elastic unit in a form locking manner. With a remaining one of its side sections or a corner region the electronic component may abut on the abutting section being fixedly mounted. The electronic component may be aligned to the fixedly mounted abutting section with one side section. Second, the electronic component may abut with one part of one first of its side sections or a corner region on the abutting section being mounted via the elastic unit. With two angled and remaining of its side sections the electronic component may abut on the abutting section being fixedly mounted in a form locking manner. The electronic component may be aligned to the fixedly mounted abutting section with two side sections. Third, the electronic component may abut with one part of one first of its side sections and may abut with one further part of a second of its side section on the abutting section being mounted via the elastic unit. With one third and a remaining fourth of its side sections the electronic component may abut on the fixedly mounted abutting section. The electronic component may be aligned to the fixedly abutting section with two side sections. According to the described first, second and third embodiment the position of the electronic component in its main plane may be fully defined.

The first abutting section may be adapted to exert a first force and the second abutting section may be adapted to exert a second force on the electronic component, wherein the first force and the second force may be at least partially opposed (particularly are exerted against one another, i.e. antiparallel) to one another. The electronic component may be aligned in the receptacle of the align fixture. The first abutting section and the second abutting section abut on side sections of the electronic component. According to the exerted forces, the electronic component may rest and be aligned if the forces exerted on the electronic component are at least not directed in one direction. The electronic component may rest, by including frictional forces, when the two forces exerted on the electronic component by the first abutting section and the second abutting section are at least partially opposed.

The first abutting section and the second abutting section may be adapted so that the first force is exerted in a main plane of the receptacle (i.e. a force vector may lie within the main

6

plane) and the second force is exerted parallel to this main plane of the receptacle. The main plane of the receptacle may be defined by being parallel to a main plain of the align fixture. The electronic component may be aligned in an appropriate way if the forces exerted by the first abutting section and the second abutting section are exerted in one plane. The first abutting section and the second abutting section may abut on side sections of the electronic component. By exerting both the first force and the second force in a main plane of the receptacle the total force on the electronic component shows no turning moment having the tendency to flip the electronic component out of the receptacle. The electronic component may be firmly aligned in the receptacle by forces being parallel to the main plane of the receptacle.

The receptacle may further comprise a base support section which forms a support surface (particularly something to hold up in position by serving as a foundation) parallel to a main plane of the receptacle. The support force exerted by the base support section may act on a main plane of the electronic component, particularly may be antiparallel to the gravitational force. The electronic component may be arranged in the receptacle so that the main plane of the receptacle and the main plane of the electronic component are parallel. The base support section acting on the electronic component may be parallel to a main plane of the receptacle so that the electronic component is aligned by the support of the base support section in the main plane of the receptacle. An advantage of supporting the electronic component in the main plane of the electronic component may be that the load on the electronic component may be dispersed on different parts of the main surfaces of the electronic component and that the first force and the second force of the first and the second abutting sections may be exerted parallel to the base support section. Thus, the orientation of the first force and the orientation of the second force may avoid cracking of the electronic component on the base support section.

The base support section may be adapted to exert a (particularly vertical) support force perpendicular to the first force and to the second force. The support force exerted by the base support section may be adapted to align the electronic component rectangular to its main plane. The technical advantage of the support force being perpendicular to the forces exerted by the first and second abutting sections may be that there is no turning moment being exerted on the electronic component. Hence, the electronic component may remain in an aligned position relative to its main plane.

The one of the first abutting section and the second abutting section being flexibly mounted may be adapted to perform a movement parallel to a main plane of the receptacle. The force exerted by the abutting section which is flexibly mounted is exerted parallel to a main plane of the receptacle. The force to align the electronic component may be provided by the elastic unit and the elastic unit may move the flexibly mounted abutting section and the electronic component in a main plane of the receptacle by the self-acting movement of the elastic unit in a main plane of the receptacle itself. Thus, the forces of the elastic unit may be exerted on the electronic component in a plane in which the electronic component is predominantly rugged or stable.

The align fixture may comprise a base support plate above which the elastic unit is arranged, wherein the elastic unit may be adapted to perform a movement parallel to a main plane of the receptacle at least partially supported by the base support plate. In one embodiment the base support plate and the elastic unit may be arranged parallel to a main plane of the receptacle and parallel to a main plane of the complete align fixture. The elastic unit may move along the base support

plate on which the elastic unit may be arranged. At least in one direction (which may be the direction oriented towards the base support plate) the elastic unit may be secured against unwanted deformation. The base support plate may be planar or may have one or more recesses adapted to guide the movement of the elastic unit.

The align fixture may comprise a base support plate and a receiving plate between which the elastic unit is arranged. The elastic unit may be adapted to perform a movement parallel to a main plane of the receptacle at least partially guided (particularly directing the motion of something) by the base support plate and the receiving plate. The receiving plate may particularly have a recess (or a receiving opening) via which the electronic component is receivable in the receptacle by insertion through the recess. In one embodiment the base support plate, the receiving plate and the elastic unit may be arranged parallel to a main plane of the receptacle and parallel to a main plane of the complete align fixture. The elastic unit may move between the base support plate and the receiving plate between which the elastic unit may be arranged. The elastic unit may be secured against deformation in two directions. The two directions against which the elastic unit may be secured may be the direction oriented towards the base support plate and the direction oriented towards the receiving plate. The base support plate and the receiving plate may be planar or may have recesses adapted to guide the movement of the elastic unit.

The align fixture may further comprise at least one distance adjusting plate adapted for adjusting thicknesses. For distance adaption purposes the align fixture may comprise even more than three plates.

The elastic unit may comprise a spring element (particularly a rubber member, any kind of elastic material member, a spring formed from a steel spring plate, a spring formed from a spring wire or any kind of springs such as flat springs, coil springs, leaf springs, etc.). The spring element may be integrally formed from a plate. The spring element may show similar properties compared to the elastic unit wherein the elastic unit may be formed from several parts. The spring element may show elastic restore forces against deformation, i.e. a Hook behaviour.

The elastic unit may comprise a first spring element and a second spring element, wherein the one of the first abutting section and the second abutting section being flexibly mounted is connected with the first spring element and with the second spring element. In one embodiment the first spring element and the second spring element are angularly arranged relative to one another. Depending on the form, material and size of the spring element it may be advantageous to combine two spring elements to an elastic unit. Even more than two spring elements may form an elastic unit. By combining two or more spring elements to an elastic unit the direction and absolute value of the force exerted by the elastic unit may be adapted. In one embodiment the first spring element and the second spring element are angularly arranged relative to one another.

The elastic unit may be a separate elastic member adapted to be mounted at an elastic unit receiving section. The elastic unit receiving section may be formed from one of the plates and may be adapted to receive a separate elastic member. To enhance the adaptivity of the align fixture the elastic unit may be a separate elastic member. One elastic unit plate or any other adapted plate may be suitable to receive different types of elastic members. As a consequence of this there may be fewer plates needed to adapt the align fixture to different sizes of electronic components. It may be possible just to change the respective size of the receptacle, the position of the elastic

unit receiving section or to change the size of the elastic members to be inserted for adapting the align fixture to different electronic component types. The separate elastic member may be detachably mounted by making it more convenient to change the align fixture.

The elastic unit receiving section may be adapted to fix the elastic unit at a suspension (particularly fastening or fixing) of the elastic unit so that the elastic unit is fixed against rotation. Otherwise the elastic member may fail in exerting a force in a defined direction. The direction and the value of the force does not vary if the elastic unit is not rotatable. Because of the miniaturization in semiconductor fabrication leading to smaller sizes of semiconductor devices there may be a need for aligning the semiconductor devices very accurately. Thus, it is advantageous to prevent the elastic member received in its suspension against rotation because the forces may be defined in direction and value.

The elastic unit may be fixedly installed in a form locking manner. The elastic unit receiving section may be adapted to fix the elastic unit in the suspension of the elastic unit wherein the elastic unit is fixedly installed with positive locking. Slipping of the separate elastic member may be prevented by fixedly installing the elastic unit in a form locking manner. The elastic unit may be prevented from falling out of the align fixture. By installing the elastic unit in a form locking manner the direction and the value of the force exerted by the elastic unit may be defined and may be maintained stable.

The first abutting section, the second abutting section, and the base support section may delimit an electronic component receiving volume in which the electronic component may be received. At least a part of the elastic unit may extend below a bottom side of the electronic component receiving volume. By arranging the elastic unit below an electronic component receiving volume the space needed for the align fixture may be kept small. For electronic components being larger than the average electronic components it may be helpful to save space in the main plane of the align fixture. Since the deflection of the elastic unit may be larger for big sized electronic components it follows that significant (for instance up to eight times of the) space may be saved by arranging the elastic unit below the electronic component receiving volume compared to an arrangement in which the elastic unit is arranged exclusively beside the electronic component receiving volume.

The one of the first abutting section and the second abutting section being flexibly mounted may extend in an upwards direction from the elastic unit to which it is mounted and this abutting section may extend aside of the electronic component receiving volume. The abutting section being flexibly mounted may extend aside of the electronic receiving volume and in the same height of the electronic receiving volume in order to be adapted to abut on the electronic component to be received. The flexibly mounted abutting section may extend from the elastic unit extending below the electronic receiving section upwardly to and aside of (i.e. outside of) the electronic receiving section and the flexibly mounted abutting section may be adapted to abut on an electronic component received in the receptacle. The first abutting section and the second abutting section may be adapted to clamp the electronic component in a space between them.

The align fixture may further comprise a frame, particularly a slidably mounted frame, wherein the first abutting section and the elastic unit are mounted on the slidably mounted frame. Such a frame may be for instance rectangular structure formed by for instance four bars or rods. The first abutting section and the elastic unit may be mounted within an area delimited by the bars or rods. The frame, in turn, may or may not be mounted fixedly or flexibly on an outer support

structure such as a plate. In one embodiment, a slidably mounted frame may comprise adjustment units to allow fine adjusting of the aligning performance of the receptacle. The first and second abutting sections may engage the electronic component and may align the electronic component with the first abutting section parallel to a main plane of the receptacle. Furthermore, the first abutting section and the elastic unit on which the second abutting section is mounted may both be mounted on a frame being slidably mounted in the main plane of the receptacle. By providing the slidably mounted frame with adjustment units it may be possible to allow fine adjustment of the receptacle and the electronic component received therein in the align fixture. The slidably mounted frame may be elastically mounted via at least one further elastic unit.

At least one of the group consisting of the first abutting section, the second abutting section, the elastic unit, the base support section and the slidably mounted frame may be at least partially integrally formed from a plate. It may be convenient to manufacture at least one functional element from a plate by using design techniques such as etching techniques or laser techniques. These techniques may be optimally suitable for applying them on thin plates, for instance metal plates. By etching or laser cutting, a high accuracy for the structures being manufactured may be achieved.

At least two of the group consisting of the first abutting section, the second abutting section, the elastic unit, the base support section and the slidably mounted frame may be at least partially integrally formed from one plate. The same advantages cited for integrally forming at least one of the functional elements from one plate hold for forming two or even more functional elements from one plate. It may be even more convenient to manufacture as many functional elements as possible using one plate. Particularly the abutting section being mounted on the elastic unit and the elastic unit may be formed from one plate. Additionally, the first abutting section may be integrally formed from one plate. Even additionally the slidably mounted frame and the at least one further elastic unit may be manufactured integrally from one plate. Thus, the first abutting section, the second abutting section, the elastic unit, the slidably mounted frame and the at least one further elastic unit may be integrally formed from one plate. When properly adapting the form of the plate it may be even possible to form also the base support section from the same plate.

The elastic unit may be adapted to exert the two force components on the one of the first abutting section and the second abutting section so that this abutting section may exert two angled force components on the electronic component. On one of the two abutting sections the elastic unit exerts two force components, wherein the respective abutting section is adapted to transfer the two force components in a manner that this abutting section exerts two angled force components on the electronic component. Two angled sides of the electronic component may be touched by one abutting section which exerts two angled forces in order to enable aligning of the electronic component within the receptacle by a further arbitrary abutting section acting only on at least one further side or one further corner region of the electronic component.

In the following, further exemplary embodiments of the carrier will be described. However, these embodiments also apply to the align fixture and to the method.

The carrier for aligning multiple electronic components may be provided with multiple align fixtures. In an embodiment, the multiple align fixtures may be integrally formed based on a common substrate (which may be constituted by one or more plates).

At least one elastic unit may be assigned to each of the receptacles. There may be one or more elastic units assigned

to one receptacle. By assigning at least one elastic unit to one receptacle there may be a way to align one electronic component independently from another electronic component. This may be advantageous since receiving and aligning one first electronic component does not have an impact on receiving and aligning another second electronic component.

At least one elastic unit may be assigned to multiple of the receptacles. The elastic unit may comprise more than one elastic sections and may be arranged in that two abutting sections are mounted on opposite sides of one elastic section. Even three, four, five or more receptacles may share one elastic unit. Moreover, it may be cost-efficient and space-saving to provide one elastic unit with more than one elastic section. It may be appropriate to provide an elastic unit plate with as many elastic units and elastic sections, respectively, as there are receptacles or electronic components, respectively.

The carrier may be provided with a first plate comprising the elastic units and a second plate comprising the second abutting sections, wherein the first plate is arranged slidably with respect to the second plate and wherein the first plate is adapted to allow for a mutual relocation of the multiple first abutting sections relative to the second abutting sections. According to an exemplary embodiment of the invention, the carrier may comprise multiple receptacles each receiving an assigned one of the multiple electronic components. The size of the multiple receptacles may be delimited by the first abutting sections of the first plate and the second abutting sections of the second plate. The first abutting sections of the first plate and the second abutting sections of the second plate may lie on opposed sides of the receptacles. The first plate and the second plate may be movable relative to each other along main planes of the first plate and of the second plate and the size of the receptacles may change when the relative position of the first plate and the second plate are changed relative to each other. The first plate and of the second plate may lie parallel to one another. The position of the first plate and of the second plate may be changed diagonally, i.e. a corner region of the first plate and a corner region of the second plate may be approached and contrary to this pulled apart. The movement of the first plate and of the second plate or an approach or pulling apart of the first abutting sections and the second abutting sections may take place in the main planes of the first plate and the second plate. The multiple electronic components may be clamped between the multiple first abutting sections and the multiple second abutting sections in the multiple receptacles when the corner regions of the first plate and the second plate approach. Corner regions of the receptacles may approach and pulled apart simultaneously when the corner regions of the first plate and the second plate approach and are pulled apart.

The first plate may be an elastic unit plate comprising a plurality of elastic units, wherein each of the receptacles has assigned at least one of the plurality of the elastic units. The first abutting sections may be each formed on an elastic unit respectively. The purpose of the elastic unit may be that compensatory tolerances for varying dimensions of the multiple electronic components may be permitted. Otherwise due to the varying dimensions of the electronic components the electronic components may fall out of the receptacles or misalignment may be caused. The elastic units may be particularly elastic coatings or rubber parts allowing for adjusting elastic properties of the first abutting sections. The elastic unit may also be any unit being elastic, such as any kind of springs. In an embodiment first plate and the second plate may be arranged parallel to each other. The first plate may move along the second plate on which the first plate may be arranged. At least in one direction which may be the direction

towards the second plate the first plate may be secured against unwanted deformation. The second plate may be planar or may have recesses adapted to guide the movement of the first plate.

A position or a deformation state of each of the elastic units may determine one of the boundaries of the respective assigned receptacles. The position of the elastic units may determine the dimensions of the receptacles and the deformation state of the elastic units may determine the dimensions of the receptacles. The position of the elastic units may mutually change with the position of the first plate and the second plate relative to each other. The position of each first abutting section may change relative to each second abutting section. The change of the position of the first plate and the second plate relative to each other may cause a mutual change of the dimensions of each receptacle in the same manner, i.e. the dimensions of the receptacles may increase or the dimensions of the receptacles may decrease mutually. However, each receptacle may change its dimensions individually with a change of the deformation state of the elastic unit, respectively. The deformation state of the elastic unit and the dimension of the receptacle may increase when the elastic unit is brought into a prestressed position and may decrease when tension is relieved.

The first plate and the second plate may be elastically coupled to each other by at least one plate connecting elastic unit. It may be advantageous to couple the first plate and the second plate elastically by at least one plate connecting elastic unit. The at least one plate connecting elastic unit may be under tension when the dimensions of the receptacles are mutually increased and the tension of the plate connecting elastic unit may be relieved at least partially when the first plate and the second plate change their positions to decreased dimensions of the receptacles. The dimensions of the receptacles may be mutually decreased when the tension of the at least one plate connecting elastic unit is relieved in a self-acting manner.

The second plate may comprise a first plate abutting section adapted for abutment of the first plate. The first plate may comprise a second plate abutting section adapted for abutment of the second plate. The second plate abutting section and the first plate abutting section may define a clamping size of the receptacles when the first plate abutting section and the second plate abutting section abut on each other, wherein the clamping size of the receptacles may be adapted for a clamping of the electronic components in the respective receptacles. A clamping size of the receptacles, wherein each receptacle may be adapted to clamp a respective electronic component, may be provided by a position of the first plate and the second plate relative to each other. The term "clamp" may particularly denote that the carrier may be designed to have parts brought together for holding or compressing the electronic components. The parts which may be brought together are the first abutting section and the second abutting section.

The plate connecting elastic element and the plurality of elastic units may be adapted to provide a total force for a self-acting transition from an enlarged size of the receptacles in which the electronic components may be receivable in the receptacles towards a reduced clamping size of the receptacles in which the electronic components may be clamped. The total force may be defined by a force exerted by the at least one plate connecting elastic unit minus a force exerted by the plurality of elastic units when the electronic components come into clamping positions. The force of the at least one plate connecting elastic unit may be greater than the force exerted by the plurality of elastic units. The total force may be

positive and may provide a self-acting transition from an enlarged size of the receptacles to a clamping size of the receptacles where the second plate abutting section of the first plate and the first plate abutting section of the second plate may abut on each other.

The carrier may further comprise handling structures formed at the first plate and at the second plate. The handling structures may be adapted for handling the first plate and the second plate to relatively move the slidably arranged first plate and second plate against a force of the plate connecting elastic element towards an enlarged size of the receptacles. The handling structures of the carrier may be adapted to relatively move the first plate and the second plate against the total force provided by the force of the at least one plate connecting elastic unit minus the force of the plurality of elastic units. The handling structures may be adapted to enlarge the receptacles against the total force to the enlarged size in which the bodies of the electronic components are receivable in the receptacles.

The carrier may be provided with a first plate, a second plate and a third plate, wherein the first plate comprises the elastic units and the second plate comprises the second abutting sections, wherein the first plate is arranged floatingly between the second plate and the third plate, and wherein the first plate is adapted to allow for a mutual relocation of the multiple first abutting sections relative to the multiple second abutting sections. The first plate may be adapted to allow for a mutual relocation (particularly floating) of the first abutting sections flexibly mounted via the elastic units. The carrier may comprise a third plate, wherein the first plate may be arranged floatingly between the second plate and the third plate, wherein the second plate and the third plate may be fixedly mounted to each other. The first plate may be the elastic unit plate and may be adapted to allow for a mutual floating (particularly connected or constructed so as to operate and adjust smoothly) of the first abutting sections. The term "float" may particularly denote a drift without a defined external control. In particular "float" may denote that the first plate may change its position relative to the second plate and the third plate with small or negligible friction forces. The handling structures may be adapted to move the first plate towards an enlarged size of the receptacles against the total force. The plate connecting elastic unit may be adapted to move the first plate towards the clamping size of the receptacles. The first plate, the second plate and the third plate may be arranged parallel to each other. The first plate may move along the second plate and the third plate between which the first plate may be arranged. The first plate may be secured against unwanted deformation in each direction which may be the direction towards the second plate and the direction towards the third plate. The second plate and the third plate may be planar or may have recesses adapted to guide the movement of the first plate.

The second plate may be the base support plate and may comprise the base support sections which may be adapted to support main surfaces of the electronic components. The base support sections of the receptacles may be formed from the second plate. The base support plate assigned to the respective receptacle may extend to a second plate integrally formed from one plate or made up of multiple base support plates. The orientation of the second plate may be parallel to each of the receptacles and may be parallel to each of the base support sections. The support force exerted by each of the base support sections may act perpendicularly on main planes of the electronic component and may be parallel to each other.

The third plate may be the receiving plate and may be adapted for delimiting at least partially a receiving opening of

the receptacle. The third plate may cover the first plate. Through the third plate the electronic components may be put into the receptacles of the carrier. The third plate may be integrally formed from one plate or may be made up of multiple receiving plates.

The first plate or the third plate may comprise one of the first abutting sections and the second abutting sections which are fixedly mounted. The first abutting sections and the second abutting sections may be formed from the first plate or the third plate. When the abutting section being fixedly mounted is formed from the first plate, which may particularly be denoted as elastic unit plate, this abutting section may be situated at the same height like the second abutting section. This may be advantageous for electronic components being extremely thin. When the abutting section being fixedly mounted is formed from the third plate the size of the receptacles may be varied by approaching the first abutting sections and the second abutting sections mutually or by pulling apart the first abutting sections and the second abutting sections.

In the following, further exemplary embodiments of the method will be described. However, these embodiments also apply to the align fixture and to the carrier.

The method may further comprise placing the carrier in a post processing machine and subsequently subjecting the electronic components to an operation of the post-processing machine while the electronic components maintain in aligned positions in the receptacles of the carrier. A method of post-processing may particularly denote a process of evaluation or test of electronic components. Hence, a post-processing machine may particularly denote a machine for evaluating or testing of electronic components. During post-processing the electronic components may be subjected under various physical conditions to get information about the quality of the electronic components. Post-processing may particularly denote a quality test or a quality evaluation of the electronic component by subjecting the electronic components under the various electrical and/or mechanical conditions of interest.

The method may further comprise elastically clamping the electronic components by the clamping mechanism exclusively on side sections of the electronic components. The electronic components may be placed in enlarged receptacles of a carrier and thereupon may be elastically clamped and aligned by a clamping mechanism in a clamping size of the receptacles. The transition of the enlarged size of the receptacles to a clamping size of the receptacles may take place in a main plane of the receptacle. The main plane of the receptacle may match with a main plane of the carrier, with a main plane of the electronic component and with a main plane of the align fixture. The carrier may be put into a post-processing machine. While the electronic components are clamped and aligned in the receptacles the electronic components may be subjected to operations of the post-processing machine.

The method may further comprise providing the carrier with an identifying feature or an identifier for definite (particularly precise, unique or unambiguous) identification of the carrier. Post-processing machines may form an assembly line. The carriers may be transported from one post-processing machine to a further post-processing machine. A unique identification of each of the carriers in a plant during post-processing enables tracking (particularly tracing) the way of each of the carriers in the plant and enables tracking each of the electronic components. Thus, by the identifying feature each of the carriers and each of the electronic components may be tracked in an assembly line.

The method may further comprise providing the carrier with fiducial markers for fiducial detection. A vision system

together with fiducial markers or marks may provide a detection of the position and orientation of the carrier in a post-processing machine. This may be advantageous when operating processes which need accurate alignment of the carrier such as for marking or contacting the electronic components.

The method may comprise aligning the electronic components with the second abutting sections, wherein the first force may be exerted in a self-acting manner by elastic (particularly flexible, resilient or springy) units (particularly a piece or complex of apparatus serving to perform one particular function) to which the first abutting sections are mounted. Each one of the first abutting sections may be mounted at least to an assigned one of the elastic units. The elastic units may each exert the first forces towards the second abutting sections. Each one of the second abutting sections is assigned to one of the first abutting sections. The electronic components may be aligned with the second abutting sections.

The method may further comprise exerting two force components on at least one of the first abutting sections and the second abutting sections so that this abutting sections exert two angled force components on the electronic components.

The post-processing may comprise laser marking while the electronic components are held and aligned by the carrier and are moved by handling the carrier. While the electronic components are clamped and aligned in the receptacles the electronic components may be subjected to a laser marking procedure. The electronic components may have an accessible symbol side independent of whether the contact side abuts with the base support section or whether the symbol side abuts with the base support section. If the contact sides abut with the base support sections the symbol side lies open to the receiving side and may be subjected to laser marking without any restrictions. If the symbol sides abut with the base support sections the base support sections of the receptacles may have access openings in their centres extending only so far that the edge regions of the electronic components still abut with the base support sections.

The post-processing may comprise a burn-in test while the electronic components are held and aligned by the carrier and are moved by handling the carrier. In a burn-in test the electronic components, especially semiconductor devices, may be subjected to heat for a predefined time interval (for instance temperatures of up to 200° C. for a fraction of an hour up to several hours). During the burn-in test the electronic components may be additionally subjected to a power test by a current feed and/or the electronic components may be subjected to an electronic test for testing the electronic quality of the electronic components. The carrier may be adapted to withstand high temperatures by forming the carrier of temperature resistant materials like metal, thermosetting plastics or resins.

The post-processing may comprise a bake-in process while the electronic components are held and aligned by the carrier and are moved by handling the carrier. The bake-in process may be a process where the electronic components are heated for a predefined time interval (for instance temperatures of up to 200° C. for a fraction of an hour up to several hours) without any electrical test or load. Forming the carrier from temperature resistant materials may enable the carrier to withstand bake-in processes, wherein the electronic components are subjected to high temperatures for a period of about one hour. The bake-in process may be used to reduce electrical load on the electronic components to further continue with a final test.

The post-processing may comprise a final test on a handler while the electronic components are held and aligned by the

15

carrier and are moved by handling the carrier. The final test having a variety of embodiments may be a test being carried out before the electronic components are assembled. The final test of electronic components, e.g. semiconductor devices, may be an electronic functional test and may comprise a variety of physical test conditions, such as a variety of temperatures, pressures, accelerations and inclination angles in an arbitrary combination. Forming the carrier from a material or materials which withstand the mechanical and temperature strain the carrier may be adapted to align the electronic components under these variable conditions and may be adapted to allow for a contacting the contacts of the electronic components.

In an embodiment the post-processing does not comprise or is free of a final test on a handler while the electronic components are held and aligned by the carrier and are moved by handling the carrier. After laser marking, burn-in or bake-in directly a selective marking may be operated on the electronic components.

The post-processing may comprise a selective marking while the electronic components are held and aligned by the carrier marking and are moved by handling the carrier. With reference to the explanation of the laser marking same is valid for selective marking, e.g. laser marking: The electronic components may have an accessible symbol side independent of whether the contact side abuts with the base support section or whether the symbol side abuts with the base support section. If the contact sides abut with the base support sections the symbol side lies open to the receiving side and may be subjected to laser marking without any restrictions. If the symbol sides abut with the base support sections the base support sections of the receptacles may have openings in their centres extending so far that the edge regions of the electronic components abut with the base support sections. After selective marking the electronic components placed in the carrier may be selectively marked "positive", selectively marked "negative" or may be completely marked either "positive" or "negative". Other classifications (different from "positive" or "negative") are possible as well. The selective marking may also comprise a mark pointing out a quality feature of the electronic components, e.g. a mark which signs the maximum frequency to operate a semiconductor device.

At least two of the group consisting of the laser marking, the burn-in test, the bake-in, the final test and the selective marking may be performed without removing the electronic components from the carrier. In other words, multiple of these or other procedures may be carried out while the electronic component remains aligned in the carrier. The carrier may be adapted to withstand a variety of physical conditions and may accurately align the electronic component through complete or partial post-processing. Thus, the electronic components may be held and aligned in the carrier during the complete post-processing or parts of post-processing.

After the post-processing the electronic components may be removed from the post-processing machine by removing the carrier from the post-processing machine while the electronic components are held and aligned by the carrier.

The aspects defined above and further aspects of the invention are apparent from the examples of embodiment to be described hereinafter and are explained with reference to these examples of embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in more detail hereinafter with reference to examples of embodiment but to which the invention is not limited.

16

FIG. 1 to FIG. 4 show different align fixtures according to exemplary embodiments of the invention.

FIG. 5 shows a detailed view of and FIG. 6 shows an overview of a carrier according to an exemplary embodiment of the invention.

FIG. 7 shows an exploded view of a carrier according to an exemplary embodiment of the invention.

FIG. 8 shows an overview of a carrier according to an exemplary embodiment of the invention.

FIG. 9 shows a detailed view of and FIG. 10 shows an overview of a carrier according to an exemplary embodiment of the invention.

FIG. 11 shows a detailed view of and FIG. 12 shows an overview of a carrier according to an exemplary embodiment of the invention.

FIG. 13 shows a detailed view of and FIG. 14 shows an overview of a carrier according to an exemplary embodiment of the invention.

FIG. 15 shows a detailed view of a carrier according to an exemplary embodiment of the invention and FIG. 16 shows an overview of a carrier according to an exemplary embodiment of the invention.

FIG. 17 and FIG. 18 show a detailed view of a carrier according to an exemplary embodiment of the invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

The illustration in the drawing is schematically. In different drawings, similar or identical elements are provided with the same reference signs.

FIG. 1 shows a schematic view of an align fixture 10 according to an exemplary embodiment of the invention in an operation state before completely engaging an electronic component 1.

Align fixture 10 is adapted for aligning an electronic component 1 and comprises a receptacle adapted to receive the electronic component 1 therein. The receptacle has a first abutting section 32, 34 and a second abutting section 52, 54 as will be explained below in further detail. The align fixture 10 also has an elastic unit 41. The second abutting section 52, 54 is not coupled to the elastic unit 41 and is therefore mounted in a spatially fixed way. The first abutting section 32, 34 is flexibly mounted via the elastic unit 41. Each the first abutting section 32, 34 and the second abutting section 52, 54 forms a stiff member, i.e. an intrinsically rigid or inflexible member. The first abutting section 32, 34 and the second abutting section 52, 54 are together adapted to engage the electronic component 1 using compressing spring forces provided by the elastic unit 41. More precisely, the elastic unit 41 is oriented and mounted to exert a diagonal force 101 (constituted by two orthogonal force components 102, 104) on the first abutting section 32, 34. The force components 102, 104 are angled relatively to one another.

A first part 32 of the first abutting section 32, 34 and a second part 34 of the first abutting section 32, 34 are angled relative to each other and engage together one corner region of the electronic component 1. The first part 32 of the first abutting section and the second part 34 of the first abutting section together form the first abutting section 32, 34 mounted at an elastic unit 41. The elastic unit 41 is prestressed (or mechanically biased) and exerts the first force 101 on the electronic component 1, wherein the first force 101 is angular or skew relative to the electronic component 1 since the elastic unit 41 is arranged angularly or skew. The first force 101 shows the first force component 102 exerting a perpendicular force from the first part 32 of first abutting section, and

17

the first force **101** shows the second force component **104** exerting a perpendicular force from the second part **34** of first abutting section to angled side sections of the electronic component **1**. Together the first force component **102** and the second force component **104** engage the electronic component **1** angularly on angled side sections of the electronic component **1**.

Although not shown in FIG. 1, elastic unit can be controlled manually by an operator or by a control unit (such as an electronic and/or mechanical controller) so that the compression state and consequently the force **101** generated by the elastic unit **41** may be adjusted.

FIG. 2 shows the align fixture **10** of FIG. 1 in another operation state. FIG. 2 only differs from FIG. 1 in that the tension of the elastic unit **41** is at least partially released and the electronic component **1** is engaged by both the first abutting section and the second abutting section. The elastic unit **41** may be still stressed. The second abutting section comprises first part **52** and second part **54** forming a stiff member and being fixedly mounted at a second abutting section fixing **85** such as a rigid bar. The first part **52** of the second abutting section and the second part **54** of the second abutting section exert forces to engage the electronic component **1** in conjunction with the first part **32** of the first abutting section and the second **34** part of the first abutting section. The first part **52** of the second abutting section and the second part **34** of the first abutting section lie opposed to each other as well as the first part **54** of the second abutting section and the first part **32** of the first abutting section lie opposed to each other. Each of the first part **32** of the first abutting section, the second part **34** of the first abutting section, the first part **52** of the second abutting section and the second part **54** of the second abutting section engages another different side section of the electronic component **1**.

The elastic unit **41** may be a spring element **43** such as a coil spring, a leaf spring or a meander-shaped planar spring.

FIG. 3 shows an embodiment in which a first abutting section **31** is straight and engages a corner region **9** of the electronic component **1**. The first abutting section **31** is mounted at the spring element **43** and exerts a first force **101** which is skew or angular relative to the electronic component **1**, due to the spring element **43** being arranged angular or skew relative to the side sections **5**, **6**, **7**, **8** of the electronic component **1**. This means that the direction of a force exerted by the spring element **43** is not only parallel or rectangular to side sections of an electronic component **1** having a rectangular shape. The first force **101** is exerted by the first abutting section **31** and is generated by the spring element **43**. The first force **101** effectively comprises the first force component **102** and the second force component **104**. The first force component **102** exerts a force perpendicularly directed towards the second part **54** of the second abutting section and the second force component **104** exerts a force perpendicularly directed towards the second part **52** of the second abutting section. A second force **109** opposed to the first force **101** is exerted by the second part **54** of the second abutting section towards a first side section **5** of the electronic component **1** and is exerted by the first part **52** towards a fourth side section **8** of the electronic component **1**. The second abutting section comprises the first part **52** and the second part **54** and is fixedly mounted at the fixing **85**. The electronic component is engaged by the first part **52** of the second abutting section engaging on the fourth side section **8** of the electronic component **1**, by the second part **54** of the second abutting section engaging on the first side section **5** of the electronic component **1** and by the first abutting section **31** engaging on a corner region **9** of the electronic component. The first side section **5**

18

and the fourth side section **8** lie angularly to a corner region of the electronic component which corner region lies opposite to the corner region **9** engaged by the abutting section **31**. Thus, the electronic component is engaged on at least at three points on three different side sections.

FIG. 4 shows another embodiment of an align fixture. The second abutting section **51** is straight and fixedly mounted at the fixing **85**. The first abutting section being flexibly mounted at the spring element **43** comprises the first part **32** and angularly to it the second part **34**. The first part **32** of the first abutting section engages a third side section **7** of the electronic component **1** and the second part **34** of the first abutting section engages a second side section **6** of the electronic component **1**. The first part **32** of the first abutting section and the second part **34** of the first abutting section exert together the first force **101** on the two side sections **6** and **7** of the electronic component **1**. The first force **101** may be split in a first force component **102** exerted by the first part **32** of the first abutting section on the third side section **7** of the electronic component **1** and in a second force component **104** exerted by the second part **34** of the first abutting section on the second side section **6** of the electronic component **1**. The first abutting section and the second abutting section **51** together engage the electronic component **1** at least on three points of the electronic component **1**. The electronic component **1** is engaged by the fixedly mounted and straight second abutting section **51** and by the first abutting section comprising a first part **32** angled to a second part **34**.

The embodiments according to FIG. 3 and FIG. 4 have in common that the spring element **43** exerts the first force component **102** and the second force component **104** on the first abutting section or on the second abutting section, wherein the first force component **102** is angled to the second force component **104**.

FIG. 5 shows a detail of a first plate **110** of an align fixture according to an exemplary embodiment of the invention, the first plate **110** comprising elastic unit **41**. The align fixture shown in FIG. 5 forms part of a carrier according to an exemplary embodiment of the invention. A larger part of this carrier is shown in FIG. 6.

Again referring to FIG. 5, the detail shown here is located in a corner region of the carrier. The size of the detail shown in FIG. 5 basically corresponds to the align fixture **10**. A receptacle **20** (illustrated schematically with dashed lines) may comprise the first part **32** of the first abutting section **31**, the second part **34** of the first abutting section **31**, the first part **52** of the second abutting section **51**, the second part **54** of the second abutting section **51** and a base support section **71**. The base support section **71** may extend at the bottom side of the receptacle **20**. The first abutting section **31** is formed by the first part **32** and the second part **34** which first part **32** and second part **34** are angled to each other and the first abutting section **31** is a stiff member. The second abutting section **51** is formed by the first part **52** and the second part **54** which first part **52** and second part **54** are angled to each other and the second abutting section **51** is a stiff member. Thus, the receptacle **20** is formed by the first abutting section **31**, the second abutting section **51** and the base support section to receive the electronic component **1**. The first abutting section **31** and the second abutting section **51** may extend from a spring unit plate **110** upwards to be adapted to abut on side sections of the electronic component **1**. The base support section **71** may comprise a section near the first abutting section **31** and a section near the second abutting section **51**. A first abutting section actuation hole **39** is adapted to be actuated by a pin (not shown) or the like to bring the elastic unit **41** in a pre-stressed position. The elastic unit **41** may comprise a first

19

spring element 42 and a second spring element 44 wherein each of the first spring element 42 and the second spring element 44 extends from the first abutting section 31 towards the second abutting section 51 at the bottom side of the receptacle 20, wherein the first abutting section is flexibly mounted in this manner.

FIG. 6 shows a detail of a carrier 100 comprising the first plate 110 with several align fixtures 10. The first plate 110 comprises the align fixtures 10 and the same number of elastic units 41, first abutting sections 31 and second abutting sections 51. In each of four align fixtures 10 one electronic component 1 is placed. The electronic components 1 are placed upside down in the receptacle 10, so that a contact side 2 and a first side section 5 and a second side section 6 can be seen directly. A fiducial element 118 may be located at one side section of the first plate 110.

FIG. 7 shows an exploded view of a detail of the carrier 100. The carrier 100 may comprise a first plate 110 which may carry the receptacles 20 and which may be denoted as elastic unit plate. The carrier 100 may additionally comprise a second plate 120 which may be denoted as base support plate and a third plate 130 which may be denoted as receiving plate. The receiving plate 130 may comprise receiving openings 135 through which the electronic component 1 is to be received in the receptacles 20 of the align fixture 10. In this view twelve receiving openings 135 can be seen. However, the carrier 100 may comprise an arbitrary number of receiving openings 135 and a corresponding number of align fixtures 10 and receptacles 20. The electronic components 1 are depicted upside down so that a contact side 2 and a first side section 5 and a second side section 6 can be seen directly. The fiducial element 118 may be located on a side section of each plate, the first plate 110, the second plate 120 and the third plate 130.

FIG. 8 shows a view of a detail of a complete carrier 100 which may comprise the first plate 110, the second plate 120 and the third plate 130. Since the third plate 130 covers the first plate 110 and the second plate 120 only the receptacles 20 of the align fixture 10 may be seen. Again the electronic components 1 are depicted upside down so that a contact side 2 and a first side section 5 and a second side section 6 can be seen directly.

FIG. 9 shows a perspective view from above of a detail of the elastic unit plate 110 depicting an align fixture 10. The align fixture 10 comprises the receptacle 20. The receptacle 20 comprises first abutting section 31, second abutting section 51 and base support section 71. The align fixture comprises the elastic unit 41 having a first spring element 42 and a second spring element 44. The first abutting section 31 is mounted at the elastic unit 41. Thus, the first spring element 42 and the second spring element 44 (both configured as a meandrical structure formed out of the elastic unit plate 110) allow for an elastic movement of the first abutting section 31. The first abutting section 31 comprises first part 32 and second part 34 being angled with respect to each other and forms a stiff member. By actuating the first abutting section actuation hole 39 with an appropriate actuator such as a pin the elastic unit 41 is brought into a prestressed state where the receptacle 20 is enlarged since the first abutting section 31 is moved away from the second abutting section 51. The second abutting section comprises the first part 52 and the second part 54. The first part 32 of the first abutting section 31 lies opposed to the second part 54 of the second abutting section 51. The second part 34 of the first abutting section 31 lies accordingly opposite to the first part 52 of the second abutting section 51. The first abutting section 31 and the second abutting section 51 are therefore adapted to engage an electronic

20

component 1 in a space between them, wherein the elastic unit 41 exerts the force to engage the electronic component 1. In this embodiment the base support section 71 is formed by the base support plate 120. In the space between the first abutting section 31 and the second abutting section the base support plate has an access opening 125. Through this access opening 125 the symbol side of the electronic component 1 is accessible to laser marking. The first abutting section 31, the second abutting section 51 and the elastic unit 41 may be each formed from the elastic unit plate 110.

FIG. 10 shows multiple align fixtures 10 of a carrier 100, wherein each of the align fixtures 10 is adapted to align one electronic component 1. The electronic components 1 lie upside down in the receptacles 20 so that the contact side 2, a first side section 5 and a second side section 6 of the electronic component 1 is shown from a perspective view. The first spring elements 42 and the second spring elements 44 formed from the elastic unit plate 110 are depicted.

FIG. 11 shows a view from above of a detail of the elastic unit plate 110 depicting a receptacle 20 which may be a separate member and may be clipped to the elastic unit plate 110. The elastic unit plate 110 may comprise an elastic unit receiving opening 115 and an elastic unit receiving section 90. The elastic unit receiving opening 115 is adapted to receive the complete receptacle 20 of the corresponding align fixture 10. The elastic unit receiving section 90 is adapted to engage with an elastic unit fixing 82 in a form locking manner. The second abutting section 51 and the elastic unit fixing 82 together form a stiff member. Thus, the second abutting section 51 is fixedly mounted to the elastic unit plate 110. The first abutting section 31 is flexibly mounted at the second abutting section 51 via the elastic unit 41. In its main function the embodiment of the receptacle 20 is similar to the embodiment shown and discussed in FIG. 5.

FIG. 12 shows a view from above of a detail of the carrier 100 including the detail shown in FIG. 11. The elastic unit plate 110 comprises nine elastic unit receiving openings 115 with nine corresponding elastic unit receiving sections 90. Four align fixtures 10 are provided with four corresponding receptacles 20. The fiducial element 118 may be located at one side section of the first plate 110.

FIG. 13 shows a view from above of a detail of the elastic unit plate 110 depicting an align fixture 10. The align fixture 10 may comprise a first abutting section 31 and an elastic unit 41 together forming a separate member. The align fixture 10 may further comprise a second abutting section 51, wherein the second abutting section 51 is a section of the elastic unit plate 110. The separate member formed from the first abutting section 31 and the elastic unit 41 may further comprise an elastic unit fixing 82. The elastic unit fixing 82 may be a cylindrical protrusion clipped in a correspondingly shaped cylindrical recess of the elastic unit receiving section 90 in a form locking manner (for instance using a mechanical locking mechanism) and both the elastic unit fixing 82 and the elastic unit receiving section 90 may be assigned to the align fixture 10. The receptacle comprises in this embodiment at least the first abutting section 31 and the second abutting section 51. Thus, this embodiment is similar to the depiction of the align fixture in FIG. 1 and FIG. 2 and to the embodiment of FIG. 9. The elastic unit 41 comprises a first spring element 42 and a second spring element 44 both being stiffly coupled to the elastic unit fixing 82 and to the first abutting section 31. The first spring element 42 and the second spring element 44 allow for an elastic movement of the first abutting section 31. The first abutting section 31 and the elastic unit 41 are integrally formed from a common plate in the embodiment of FIG. 13. The first abutting section 31 comprises a first part 32

21

and a second part **34** being angled to each other and forming a stiff member. By actuating the first abutting section actuation hole **39** towards the elastic unit fixing **82** the elastic unit **41** comes into a prestressed position where the receptacle **20** is enlarged since the first abutting section **31** is moved away from the second abutting section **51**. The second abutting section **51** comprises the first part **52** and the second part **54**. The first part **32** of the first abutting section **31** lies opposed to the second part **54** of the second abutting section **51**. The second part **34** of the first abutting section **31** lies accordingly opposite to the first part **52** of the second abutting section **51**. The first abutting section **31** and the second abutting section **51** are therefore adapted to engage an electronic component **1** in a space between them. In its function the embodiment of FIG. **13** is similar to the embodiment of FIG. **9**.

FIG. **14** shows a view from above of a detail of the carrier **100** including the detail shown in FIG. **13**. The elastic unit plate **110** comprises sixteen elastic unit receiving openings **114** with sixteen corresponding elastic units **41** forming sixteen align fixtures **10** arranged in a matrix-like manner. Below the elastic unit plate **110** there may be located a base support plate. The fiducial element **118** may be located at one side section of the first plate **110**.

FIG. **15** shows an align fixture **10** comprising a floatable mounted receptacle **20**. A floatable mounted frame **27** is floatably mounted via two opposing elastic units **49**. The receptacle **20** integrated in the floatable mounted frame **27** is also floatable. Adjustment units **28** arranged on the floatable mounted frame **27** allow for a fine adjustment of the floatable mounted frame **27** and hence for fine adjustment of the receptacle **20**. Three adjustment units **28** may allow for a fine adjustment of the receptacle in the main plane of the align fixture **10**.

FIG. **16** shows a schematic view from above of a complete carrier **100** having thirty-six align fixtures arranged in a matrix form of 4×9 align fixtures. Two fiducial elements **118** arranged in the edge region of the carrier **100** may be used to align the carrier **100**.

FIG. **17** and FIG. **18** show a view from above of a detail of the carrier **100**, wherein the carrier **100** comprises a slidably elastic unit plate **110** elastically coupled to an elastic unit plate frame **111** via a plate connecting elastic unit **154**. The elastic unit plate frame **111** is fixedly mounted at the receiving plate **130**. Thus, by bending the plate connecting elastic unit **154** the elastic unit plate **110** may slide relative to the receiving plate **130** having receiving openings **135** which form the second abutting sections **51**. The first abutting sections **31** mounted at the elastic unit plate **110** via the elastic units **41** may slide relative to the second abutting section **51** forming a fixed part of the receiving plate **130**. A receptacle opening **48** of the receptacle **20** formed by the first abutting section **31** and the second abutting section **51** may be enlarged by sliding the elastic unit plate **110** relative to the receiving plate **130**. By engaging elastic unit actuation hole **258** with actuation force **210** the elastic unit plate **110** may be slid relative to the receiving plate **130** and the elastic unit plate frame **111** since the receiving plate **130** and the elastic unit plate frame **111** may be fixed at fixing hole **208**. An opposing force **200** may be applied in order to fix the carrier **100** against the force of the actuation force **210**. At several fixing points **156** the receiving plate **130** and the elastic unit plate frame **111** may be fixedly coupled to each other.

Referring to FIG. **17** a first plate abutting section **134** of the second plate **130** which may be denoted as receiving plate **130** and a second plate abutting section **914** of the first plate **110** which may be denoted as elastic unit plate **110** abut with each other. A spacer **257** may be adapted to regulate the size of the

22

receptacle opening **48**. When the first plate abutting section **134** and the second plate abutting section **914** abut with each other the clamping size of the receptacle formed by the first abutting section **31** and the second abutting section **51** may be reached. The size of the receptacle opening **48** may be smaller than the electronic component **1** to be received, so that the electronic component **1** may be clamped by the first abutting section **31** and the second abutting section **51**. The space **259** between the elastic unit plate **110** and the elastic unit plate frame **111** may have the size of the spacer **257**.

Referring to FIG. **18** a receiving size of the receptacle opening **48** is shown. The space **259** between the elastic unit plate **110** and the elastic unit plate frame **111** is enlarged. Therefore, also the size of the receptacle opening **48** may be enlarged to a size where the electronic component **1** may be received in the receptacle **20**, i.e. in the space between the first abutting section **31** and the second abutting section **51**.

It should be noted that the term “comprising” does not exclude other elements or steps and the “a” or “an” does not exclude a plurality. Also elements described in association with different embodiments may be combined. It should also be noted that reference signs in the claims shall not be construed as limiting the scope of the claims. Implementation of the invention is not limited to the preferred embodiments shown in the figures and described above. Instead, a multiplicity of variants are possible which use the solutions shown and the principle according to the invention even in the case of fundamentally different embodiments.

The invention claimed is:

1. An align fixture for aligning an electronic component, the align fixture comprising:

a receptacle adapted to receive the electronic component, the receptacle having a first abutting section and a second abutting section;

an elastic unit;

wherein one of the first abutting section and the second abutting section is flexibly mounted via the elastic unit, and the other one of the first abutting section and the second abutting section is fixedly mounted;

wherein the first abutting section and the second abutting section each form a stiff member and are adapted to engage the electronic component;

wherein the elastic unit is adapted to exert two force components on one of the first abutting section and the second abutting section, the force components being angled relatively to one another;

wherein at least one of the first abutting section and the second abutting section is adapted to engage two angled side sections of the electronic component in a form locking manner;

wherein the align fixture further comprises a base support plate arranged below the elastic unit; and

wherein the elastic unit is adapted to perform a movement parallel to a main plane of the receptacle at least partially supported by the base support plate.

2. The align fixture according to claim **1**, wherein the first abutting section is adapted to exert a first force and the second abutting section is adapted to exert a second force on the electronic component, and wherein the first force and the second force are at least partially opposed to one another.

3. The align fixture according to claim **1**, wherein the first abutting section and the second abutting section are adapted so that the first force is exerted parallel to a main plane of the receptacle and the second force is exerted parallel to the main plane of the receptacle.

23

4. The align fixture according to claim 1, wherein the receptacle further comprises a base support section which forms a support surface parallel to a main plane of the receptacle.

5. The align fixture according to claim 1, further comprising:

at least one thickness adjusting plate adapted for adjusting a thickness of the align fixture.

6. The align fixture according to claim 1, wherein the elastic unit is a separate elastic member adapted to be mounted at an elastic unit receiving section of the align fixture.

7. The align fixture according to claim 1, wherein the elastic unit receiving section is adapted to fix the elastic unit at a suspension of the elastic unit so that the elastic unit is fixed to prevent rotation.

8. The align fixture according to claim 1, wherein the elastic unit is fixedly mounted at the elastic unit receiving section in a form locking manner.

9. The align fixture according to claim 1, further comprising:

a slidably mounted frame, wherein the first abutting section and the elastic unit are mounted on the slidably mounted frame.

10. The align fixture according to claim 1, wherein at least one of the group consisting of the first abutting section, the second abutting section, the elastic unit, the base support section, and the slidably mounted frame is at least partially integrally formed from a plate.

11. The align fixture according to claim 1, wherein at least two of the group consisting of the first abutting section, the second abutting section, the elastic unit, the base support

24

section, and the slidably mounted frame are at least partially integrally formed from one plate.

12. The align fixture according to claim 1, wherein the elastic unit is adapted to exert the two force components on one of the first abutting section and the second abutting section by being flexibly mounted so that this abutting section exerts two angled force components on the electronic component.

13. A carrier for aligning multiple electronic components comprising:

multiple align fixtures, each align fixture comprising:

a receptacle adapted to receive the electronic component, the receptacle having a first abutting section and a second abutting section;

an elastic unit;

wherein one of the first abutting section and the second abutting section is flexibly mounted via the elastic unit, and the other one of the first abutting section and the second abutting section is fixedly mounted;

wherein the first abutting section and the second abutting section each form a stiff member and are adapted to engage the electronic component; and

wherein the elastic unit is adapted to exert two force components on one of the first abutting section and the second abutting section, the force components being angled relatively to one another.

14. The carrier according to claim 13, wherein each of the receptacles has at least one assigned elastic unit.

15. The carrier according to claim 13, wherein at least one elastic unit is assigned to multiple of the receptacles.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT NO. : 8,281,483 B2
APPLICATION NO. : 12/858394
DATED : October 9, 2012
INVENTOR(S) : Thomas Hofmann et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 22, Claim 1, line 34	Delete “hay ing ”
	Insert -- having --

Column 22, Claim 1, line 48	Delete “east”
	Insert -- least --

Signed and Sealed this
Third Day of June, 2014

Michelle H. Lee

Michelle K. Lee
Deputy Director of the United States Patent and Trademark Office